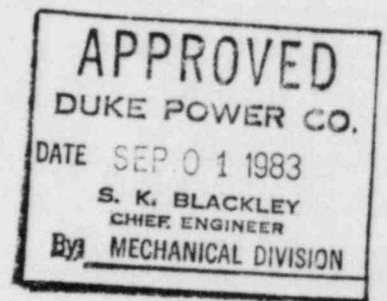


Catawba Nuclear Station
Units 1 and 2

Nuclear Safety Related Diaphragm Valves
Item 5B-473 Frequency Report



Duke Specification CHS-1205.04-00-0001

Duke Valve List CN-0150-30

MPSCo Order E66449-11

CNM 1205.04-0426

QA CONDITION 1



ITT-Grinnell Valve Company
DIA-FLO Division
33 Centerville Road
Lancaster, PA 17603

VENDOR INSTRUCTION MANUAL
 INSERTION CONTROL FORM
 (To be placed inside front of Manual)

DUKE FILE NUMBER: CNM 1205-04-0426	TRANSMITTAL NUMBER: <i>00037</i>	INSERTION CONTROL FORM: SHEET <i>1</i> OF <i>1</i>
DOCUMENT CONTROL DATE: <div data-bbox="408 426 798 677" style="border: 1px solid black; padding: 5px; text-align: center;"> DOCUMENT CONTROL DATE DEC - 6 1983 DUKE POWER COMPANY DESIGN ENGINEERING CO. </div>	APPROVED BY: <i>J.R. Kiser</i>	DATE APPROVED: <i>12-30-83</i>
	PROOFED BY: <i>N. Stuart</i>	DATE PROOFED: <i>1-5-84</i>
<p style="text-align: center;">MATERIAL REMOVED</p> <p><i>REMOVE Pages 1-4 that are directly after the MODE PLOTS. PAGE 1 HAS IMPELL LETTER NO. 0093-210-448, July 20, 1983.</i></p>	<p style="text-align: center;">MATERIAL INSERTED</p> <p><i>INSERT NEW PAGES 1 thru 4 DIRECTLY BEHIND PAGE ENTITLED FREQUENCY ITT GRINNELL ITEM 5B-473 ROTATED OPERATOR MODE NUMBER 3.</i></p>	

DESIGN VERIFICATION

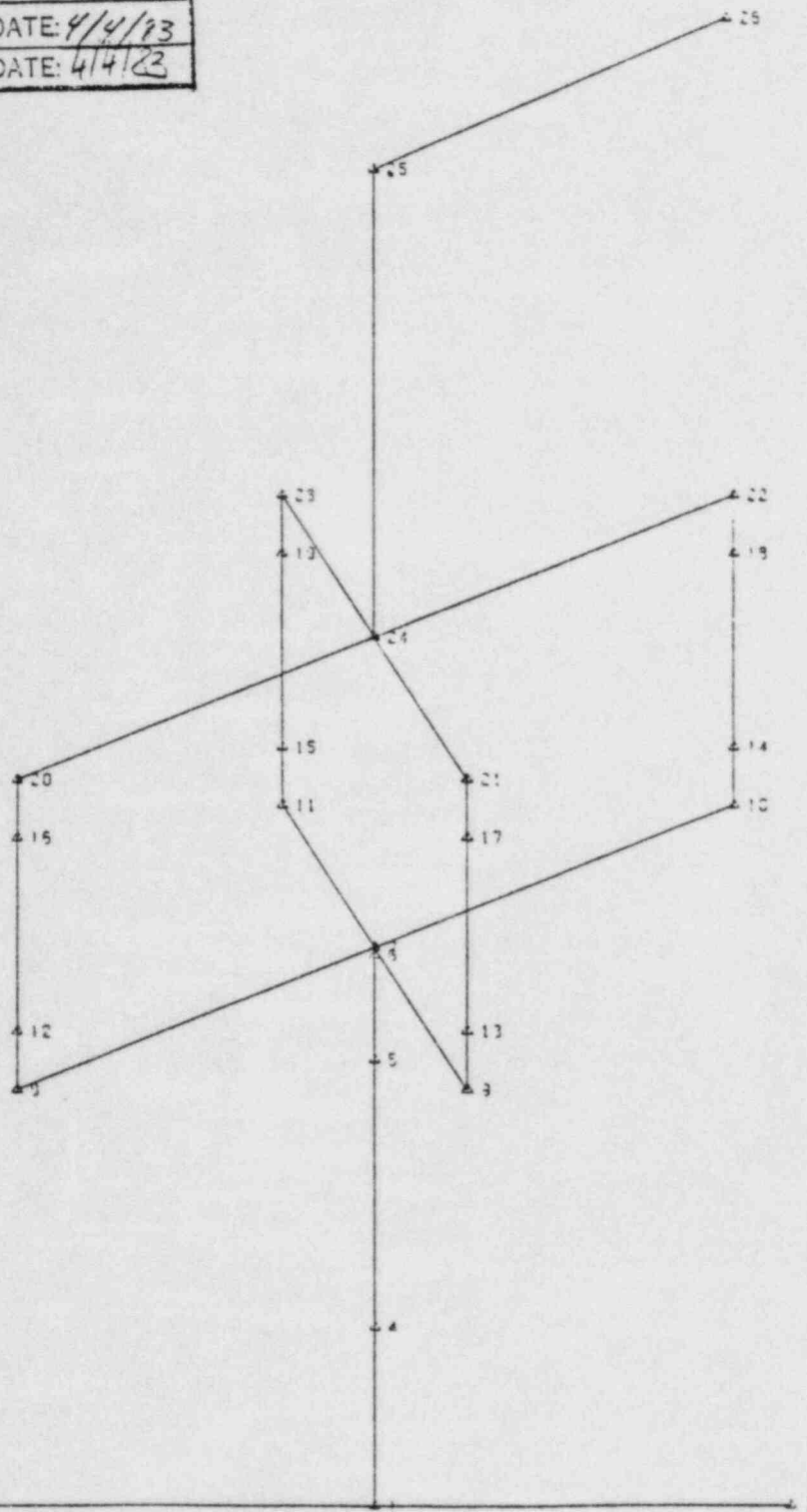
CLIENT DUKE: ATF-WBL

JOB NO. 0093-210-1362

CALC/PROB NO. 136-1

BY: DN DATE: 4/4/23

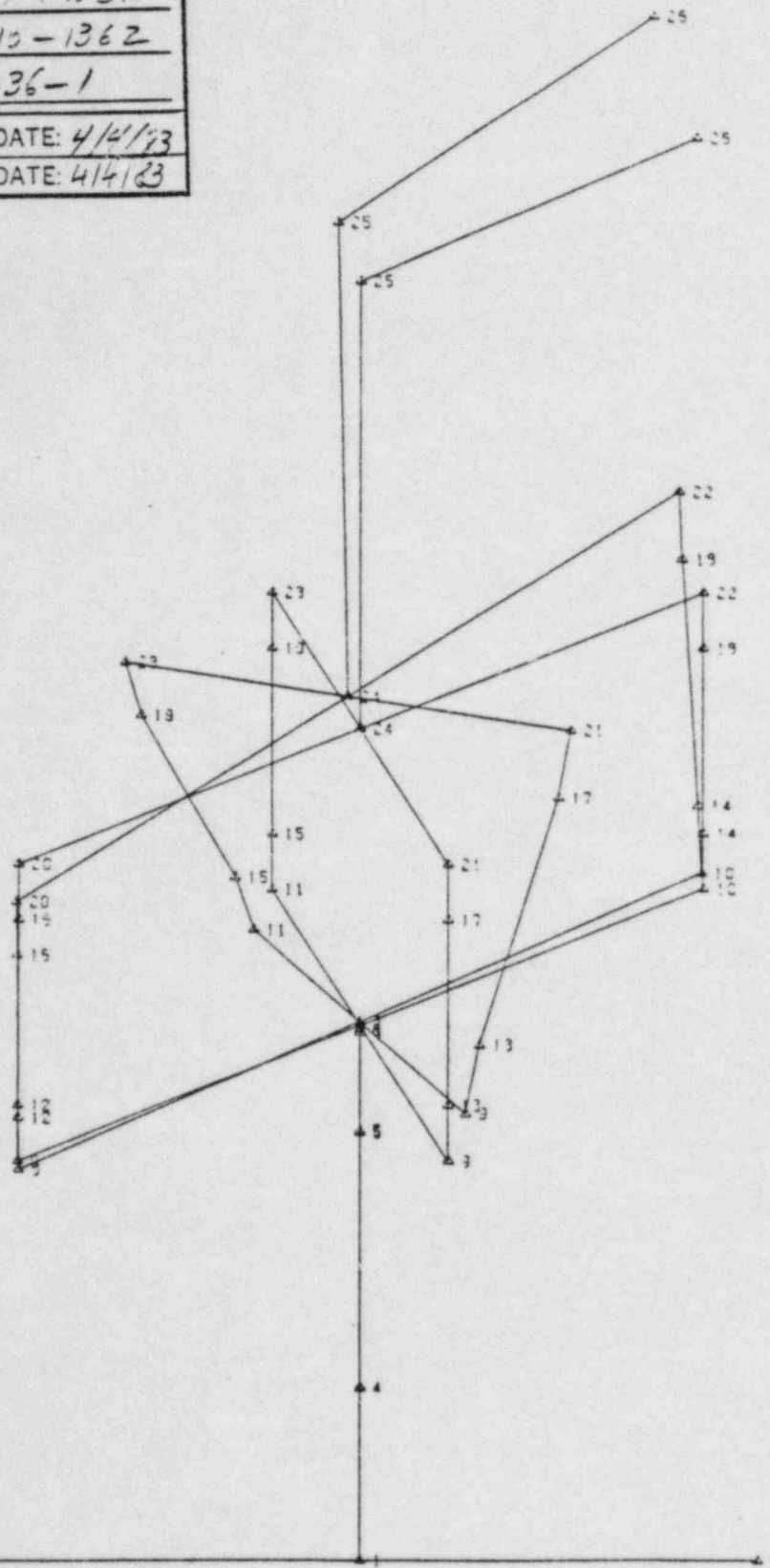
CHKD: 132 DATE: 4/4/23



DESIGN VERIFICATION


CLIENT DUKE: FFWBA
 JOB NO. 2093-210-1362
 CALC/PROB NO. 136-1

BY: DA DATE: 4/4/83
 CHKD: MJ2 DATE: 4/4/83



FREQUENCY ITT CRINNELL ITEM 5B-473 CNM-1205.04-190
 MODE NUMBER 1

FREQUENCY= 20.393 CFS

IMPELL 

DESIGN VERIFICATION

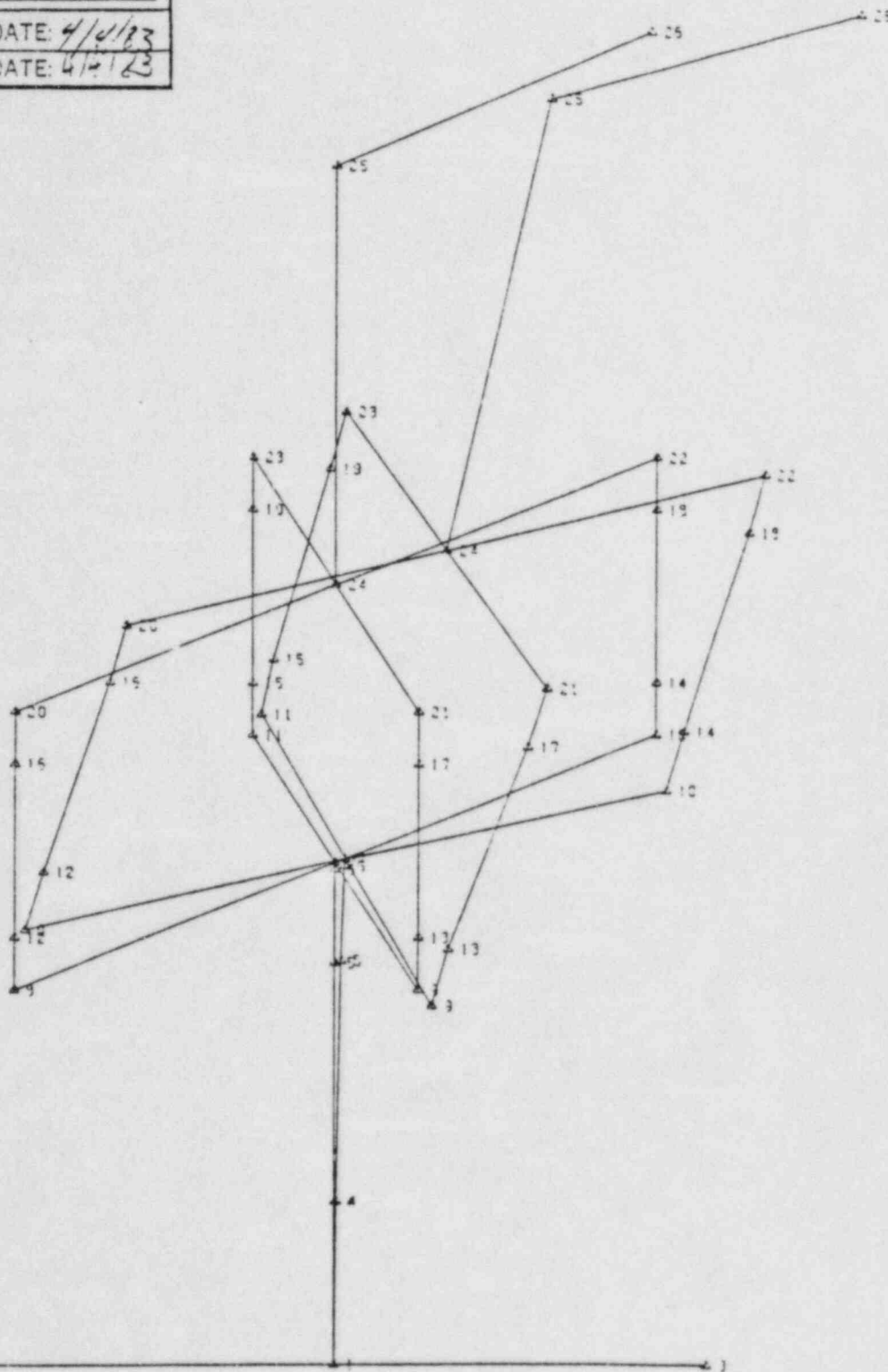
CLIENT DUKE: 04-2132

JOB NO. 0093-210-1362

CALC/PROS NO. 136-1

BY: DN DATE: 4/4/83

CHKD: MDE DATE: 4/4/83



FREQUENCY ITT CRINNELL ITEM 5B-473 CNM-1205.04-100

MODE NUMBER 2

FREQUENCY= 25.733 CPS

IMPELL CORPORATION

DESIGN VERIFICATION

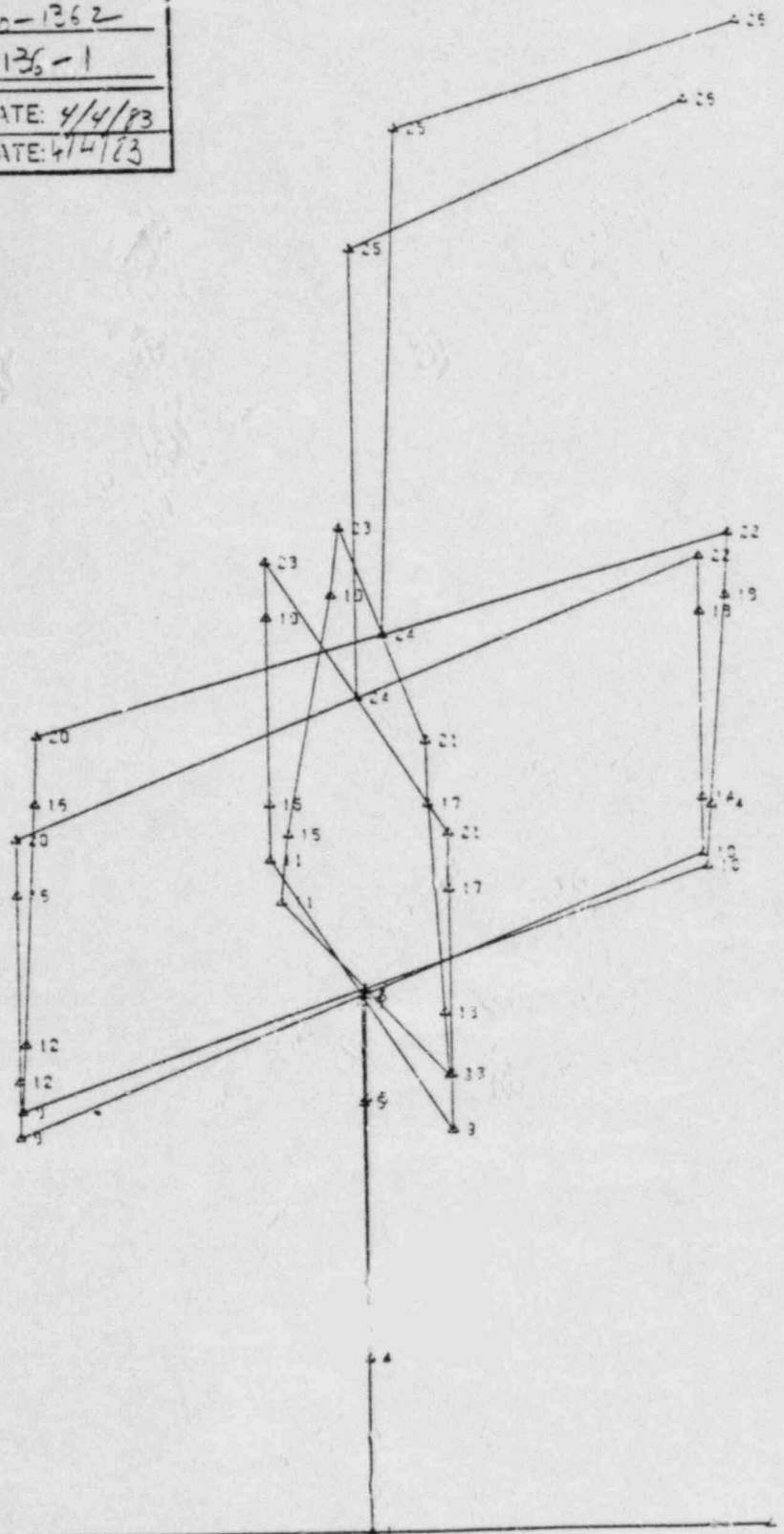
CLIENT DUKE: (ATA)NB4

JOB NO. 6093-210-1362

CALC/PROB NO. 136-1

TY: DN | DATE: 4/4/83

CHKD: YUD | DATE: 4/4/83



FREQUENCY ITT GRINNELL ITEM 56-473 CNM-1205.04-190
MODE NUMBER 3

FREQUENCY= 30.557 **IMPELL** CORPORATION

DESIGN VERIFICATION

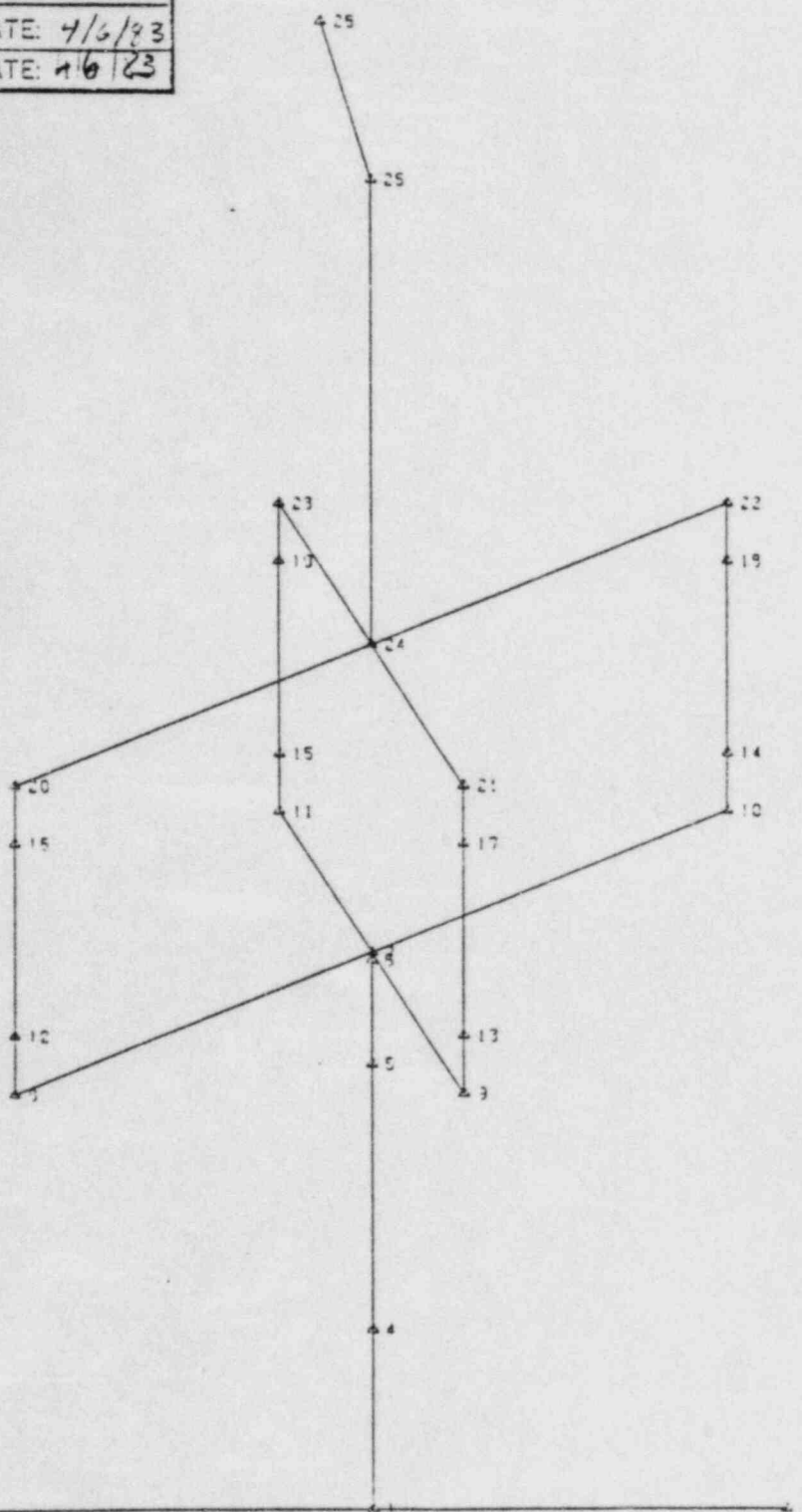
CLIENT DUKE: 24-1W21

JOB NO. 0002-210-1362

CALC/PROB NO. 136-1

BY: DN	DATE: 4/6/83
--------	--------------

CHKD: 5-2 | DATE: 4/6/23



FREQUENCY ITT GRINNELL ITEM 56-473 ROTATED OPERATOR

IMPELL 

DESIGN VERIFICATION

CLIENT DUKE: CA-10124

JOB NO. 0093-210-1362

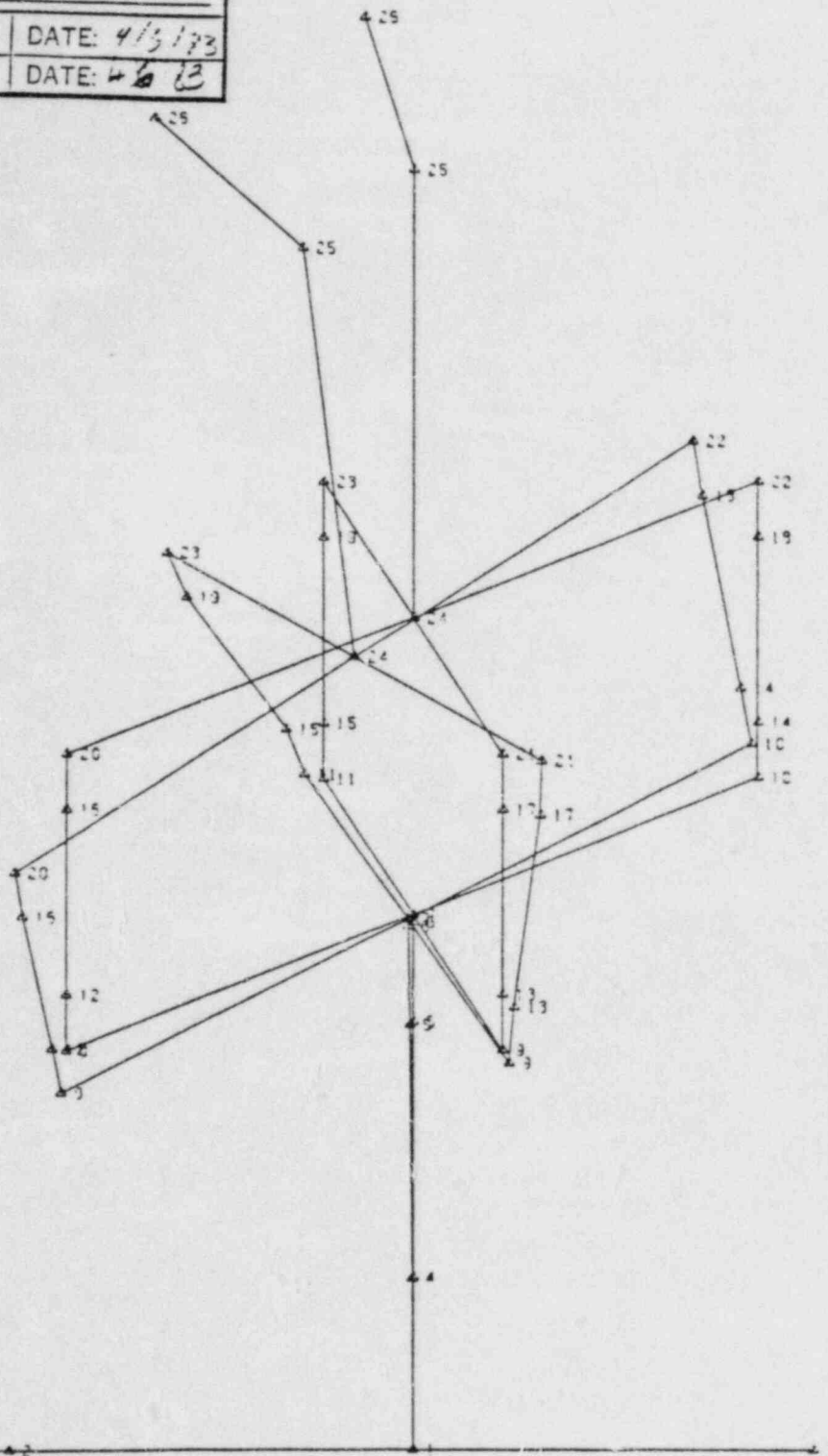
CALC/PROB NO. 136-1

BY: DAL

DATE: 4/3/73

CHKD: MSE

DATE: 4/6/73



FREQUENCY ITT CRINNELL ITEM 56-173 ROTATED OPERATOR

MODE NUMBER 1

FREQUENCY= 20.122 CPS

IMPELLER CORPORATION

DESIGN VERIFICATION

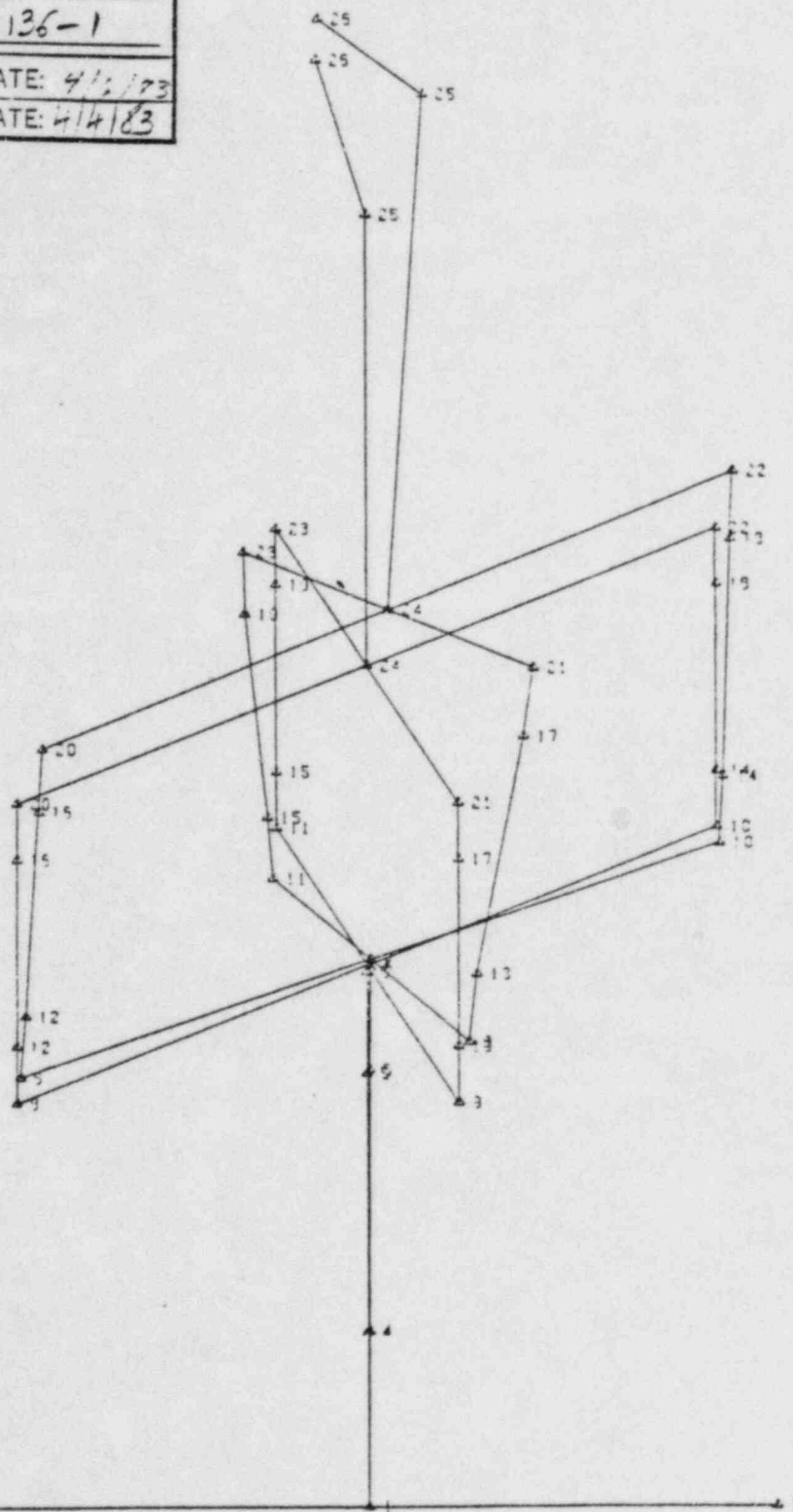
CLIENT DUKE: CATANBA

JOB NO. 0093-210-1362

CALC/PROB NO. 136-1

BY: DN | DATE: 4/1/83

CHKD: MDR | DATE: 4/4/83



FREQUENCY ITT CRINNELL ITEM SB-473 ROTATED OPERATOR
MODE NUMBER 2

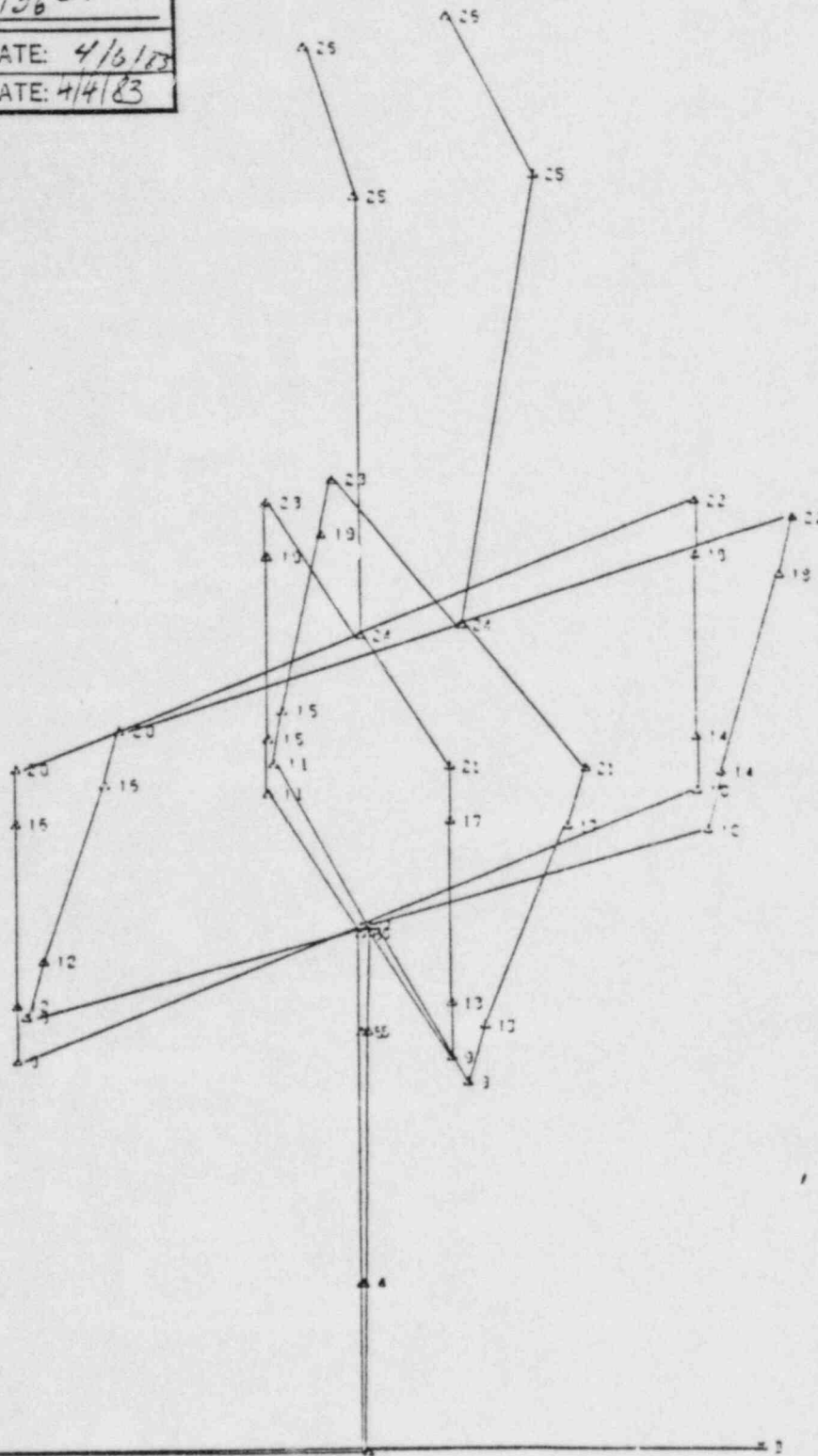
FREQUENCY = 23.353 CPS

IMPELL 

DESIGN VERIFICATION

CLIENT DUKE: CAT+WBA
 JOB NO. 0093-210-1362
 CALC/PROB NO. 136-1

BY: DN DATE: 4/6/83
 CHKD: VIDE DATE: 4/4/83



FREQUENCY ITT GRINNELL ITEM 56-473 ROTATED OPERATOR
 MODE NUMBER 3

FREQUENCY = 32.574 CFS **IMPELL** CORPORATION

ITT GRINHELL 4"-150# VALVE - ITEM 5B-473, ROTORK 14N41 MOUNTED PERPENDICULAR* TO PIPE RUN AXIS - REVISION 1
 O-FREE, 1-FIXED GLOBAL DEGREE OF FREEDOM.

Pillar Steel: SA 193, Grade B7

NODE BOUNDARY CONDITION CODES
 NUMBER C: Y Z KK VV ZZ

GLOBAL POINT COORDINATES
 X Y Z

1	3	3	0	3	0	0	0.370	0.333	0.300
2	1	1	1	1	1	1	-5.753	0.031	0.303
3	1	1	1	1	1	1	5.753	0.031	0.000
4	3	3	0	0	0	0	0.303	2.311	0.000
5	3	3	0	0	0	0	0.303	5.753	0.000
6	0	0	0	0	0	0	3.133	7.831	0.000
7	3	3	0	0	0	0	0.303	7.201	0.000
8	3	3	0	0	0	0	-3.120	7.201	2.595
9	3	3	0	0	0	0	3.120	7.201	2.595
10	3	3	0	0	0	0	3.123	7.231	-2.595
11	3	3	0	0	0	0	-3.120	7.231	-2.595
12	0	0	0	0	0	0	-3.120	7.953	2.595
13	3	3	0	0	0	0	3.120	7.953	2.595
14	3	3	0	0	0	0	3.120	7.953	-2.595
15	3	3	0	0	0	0	-3.120	7.953	-2.595
16	0	0	0	0	0	0	-3.120	10.453	2.595
17	0	0	0	0	0	0	3.120	10.453	2.595
18	0	0	0	0	0	0	3.120	10.453	-2.595
19	3	3	0	0	0	0	-3.120	10.453	-2.595
20	3	3	0	0	0	0	-3.120	11.231	2.595
21	0	0	0	0	0	0	3.120	11.231	2.595
22	3	3	0	0	0	0	3.120	11.231	-2.595
23	3	3	0	0	0	0	-3.123	11.231	-2.595
24	3	3	0	0	0	0	0.303	11.231	-2.595
25	0	0	0	0	0	0	0.300	17.231	0.000
26	3	3	0	0	0	0	-2.750	17.231	-2.306
27	1	1	1	1	1	1	233.303	230.031	3.000

DOCUMENT:
 CONTROL DATE
 DEC 6 1983
 DUKE POWER COMPANY
 DESIGN ENGINEERING

DESIGN VERIFICATION
 CLIENT: W.K.C. Control
 JOB NO.: 0-23-2113
 CALC/PROB NO.: 136-13
 BY: J.K. DATE: 10/1/83
 CHKD: J.K. DATE: 10/1/83
 HIT: 10/26 10/1/83
 P.W.D. ENR

*Rotated 90° from that shown in assembly dwg. CNM 1205.04-0190



ITT GRINNELL 4"-150# VALVE - ITEM 5B-473, ROTORK 14HAI MOUNTED PERPENDICULAR TO PIPE RUN AXIS - REVISION 1

Pillar Steel: SA 193, Grade B7

MATERIAL NO.	YOUNG S MODJLUS (PSI)	POISSON S RATIO	MASS DENSITY (#-S2/IN4)
1	2.930E+07	3.00000E-01	7.34000E-90
2	2.930E+07	3.00000E-01	1.00000E-90

ALL PROPERTIES IN INCH UNITS (AXIAL-AXIS ORIENTED FROM I TO J-NODE OF MEMBER, 1-AXIS LOCATED IN PLANE OF K-NODE ORTHOGONALLY POSITIONED TO AXIAL-AXIS, LOCAL 2-AXIS DEFINED BY RIGHT HAND RULE).

DOCUMENT
CONTROL DATE
DEC 6 1983
DUKE POWER COMPANY
DESIGN ENGINEERING

DESIGN VERIFICATION	
CLIENT	Duke - Charlotte
JOB NO.	1173-010
CALC/PROB	10/136-1A
BY	350
DATE	10/19
CHKD	11
DATE	10/18

PROPERTY	AXIAL AREA	SHEAR AREA-1	SHEAR AREA-2	TORSION-1	INERTIA-1	INERTIA-2
1	5.353E+00	2.581E+00	2.581E+00	2.404E+01	1.212E+01	1.202E+01
2	4.422E+00	2.211E+00	2.211E+00	3.511E+01	1.733E+01	1.755E+01
3	2.333E+00	1.417E+00	1.417E+00	3.156E+00	1.375E+00	1.575E+00
4	2.037E+00	1.358E+00	1.358E+00	3.820E+01	1.232E+00	9.500E+02
5	1.227E+00	9.210E+01	9.200E+01	2.410E+01	1.213E+01	1.200E+01
6	9.553E+01	4.830E+01	4.830E+01	3.950E+01	1.373E+01	1.970E+01
7	3.341E+01	2.310E+01	2.300E+01	3.300E+03	3.113E+03	3.400E+03
8	1.001E+02	1.001E+02	1.000E+02	1.000E+03	1.001E+03	1.000E+03

Pillar Steel: SA 193, Grade B7

BEAM NO	NODES		MATL		PROP
	I	J	K	NO	NO
1	1	2	27	1	1
2	1	3	27	1	1
3	1	4	27	1	2
4	4	5	27	1	2
5	5	6	27	1	3
6	6	7	27	1	6
7	7	8	1	1	4
8	7	9	1	1	4
9	7	10	1	1	4
10	7	11	1	1	4
11	8	12	1	1	7
12	9	13	1	1	7
13	10	14	1	1	7
14	11	15	1	1	7
15	12	16	1	1	5
16	13	17	1	1	5
17	14	18	1	1	5
18	15	19	1	1	5
19	16	20	1	1	7
20	17	21	1	1	7
21	18	22	1	1	7
22	19	23	1	1	7
23	24	24	27	2	8
24	24	21	27	2	8
25	24	22	27	2	8
26	24	23	27	2	8
27	24	25	27	2	8
28	25	26	27	2	8

DOCUMENT
CONTROL DATE

DEC 6 1983

DUKE POWER COMPANY
DESIGN ENGINEERING

DESIGN VERIFICATION	
CLIENT	Duke Corporation
LOG NO.	0013 210
CALCULATION NO.	14-TA
BY	SAC
DATE	11-11-83
CHKD BY	
DATE	11-11-83

ALL UNITS REPRESENTED AS LB, INCHES, SECONDS IN GLOBAL SYSTEM

MODE	APPLIED LOADS OR MASSES					
NO	RK	RY	RZ	MX	MY	MZ
25	5.933E-01	5.933E-01	5.933E-01	5.233E+01	5.319E+01	1.156E+01

IMPELLER

ITT GRINNELL 4"-150# VALVE - ITEM 5B-473, ROTORK 14NA1 MOUNTED PERPENDICULAR TO PIPE RUN AXIS - REVISION 1

Pillar Steel: SA 193, Grade B7

ANALYSIS SUMMARY:

ANALYSIS SUMMARY:

MODAL FREQ. (CPS)	MODAL TYPE	Max. Allow. Seismic Load (G) CALCULATED FOR INCLINED OPERATOR STEM (1)		Allow. Restraint Load (lbs)		
		RESULTANT OBE	RESULTANT SSE	RESULTANT OBE	RESULTANT SSE	
20.12	B	9.95	11.98	2436.76	2933.90	
23.95	T		QUALIFIED BY STATIC DEFLECTION TEST			
32.57	B	-	5.2	-	1225.0	

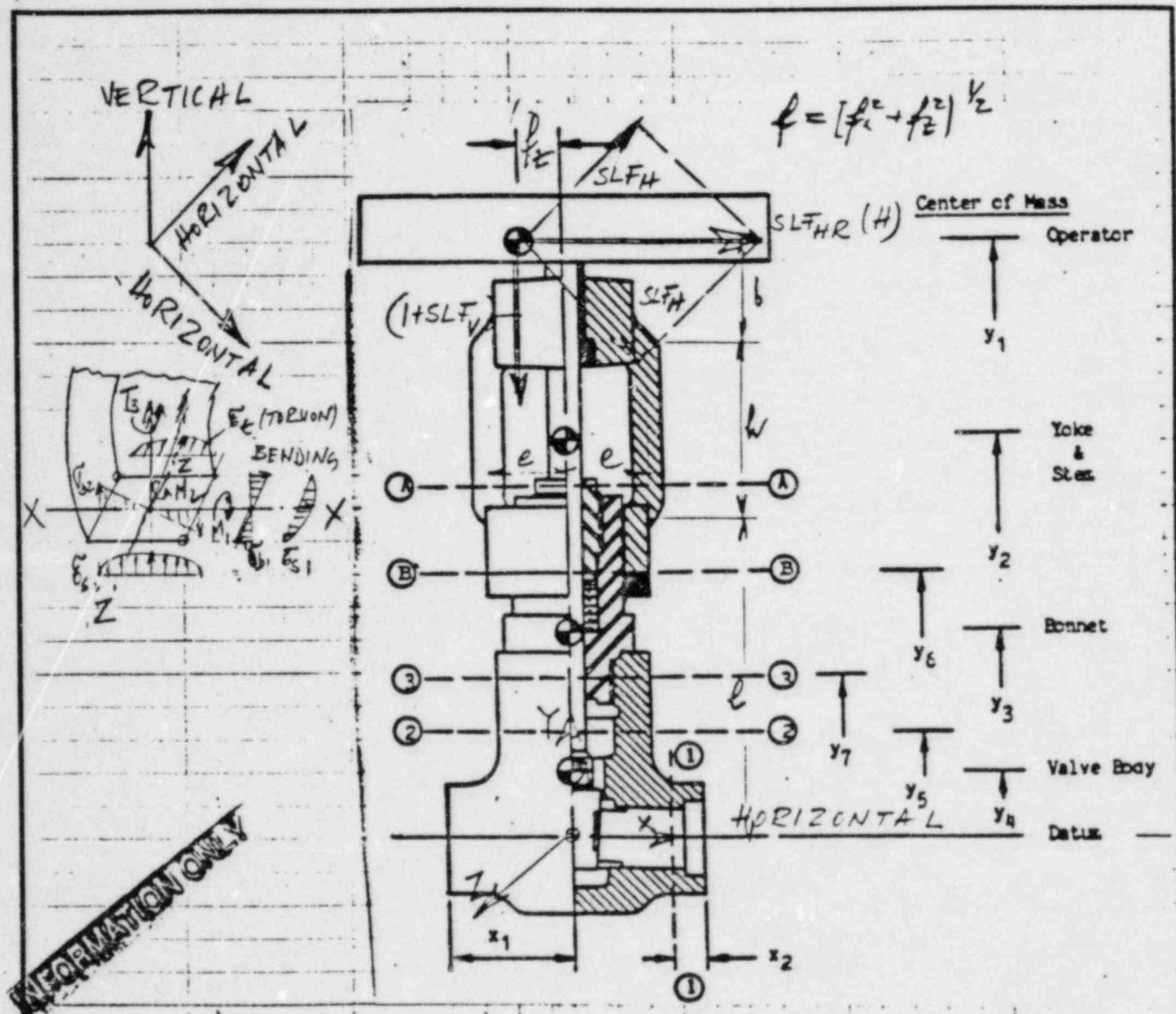
DOCUMENT
CONTROL DATE

DEC 6 1983

DUKE POWER COMPANY
DESIGN ENGINEERING


NOTE (1) Resultant applied perpendicular to operator stem axis.

DESIGN VERIFICATION	
CLIENT	DUKE/AT
JOB NO.	6692-210
CALC/PROB NO.	126-1A
BY: [Signature]	DATE: 11/8
CHKD: [Signature]	DATE: 11/8



VALVE SEISMIC ORIENTATION :

- STEM AXIS VERTICAL
- THE HORIZONTAL SEISMIC RESULTANT ACCELERATION APPLIED ON THE YOKE WEAKEST DIRECTION

					SEISMIC LOAD FACTORS CORRELATION ANALYSIS			
					JOB NO		PAGE	
	MDR	7/11/83	SL	7-11-83	CALC NO		OF 4	
REV	BY	DATE	CHECKED	DATE	eids  nuclear			

USER NUMBER = MORRAYM
JOBCARD NAME = JOB

[illegible]

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840.

FREQUENCY ANALYSIS FOR
4" 150 ITT GRINNELL VALVE, ITEM 5B-473
ROTOR 14 NAI - mounted parallel to
pipe run axis (CRM-125.04-0190)
 $f_1 = 20.38$ Hertz.

| DESIGN VERIFICATION | |
|---------------------|----------------|
| CLIENT | DUKE : CATAWBA |
| JOB NO. | 0093-210-1362 |
| CALC/PROB NO. | 136-1 |
| BY: DW | DATE: 4/2/83 |
| CHKD: MDE | DATE: 4/2/83 |

FREQUENCY ITT GRINNELL ITEM 5B-473 CNH-1205.04-190

NUMBER OF MODAL POINTS = 27
 NUMBER OF ELEMENT TYPES = 1
 NUMBER OF LOAD CASES = 1
 NUMBER OF FREQUENCIES = 3
 ANALYSIS TYPE CODE = 2
 BLANK COMMON STORAGE SPECIFIED = 7476
 RESTART CODE = 2
 NUMBER OF FREQUENCIES/BLOCK = 0
 MODES (EIGEN VALUE) ANALYSIS CODE = 2

Log. # AATQURA

| | |
|---------------------|--------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO. | 0012-210 |
| CALCIPROB NO. | 136-1 |
| BY: A. W. | DATE: 8/1/83 |
| CHKD BY: A. W. | DATE: 4/2/83 |

| NODE
NUMBER | BOUNDARY CONDITION CODES | | | | | | NODAL POINT COORDINATES | | | |
|----------------|--------------------------|---|---|----|----|----|-------------------------|---------|--------|---|
| | X | Y | Z | XX | YY | ZZ | X | Y | Z | |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 0 |
| 2 | 1 | 1 | 1 | 1 | 1 | 1 | -5.750 | 0.000 | 0.000 | 0 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 5.750 | 0.000 | 0.000 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 2.310 | 0.000 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 5.750 | 0.000 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 7.100 | 0.000 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 7.200 | 0.000 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 7.200 | 2.595 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 7.200 | 2.595 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 7.200 | -2.595 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 7.200 | -2.595 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 7.950 | 2.595 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 7.950 | 2.595 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 7.950 | -2.595 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 7.950 | -2.595 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 10.450 | 2.595 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 10.450 | 2.595 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 10.450 | -2.595 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 10.450 | -2.595 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 11.200 | 2.595 | 0 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 11.200 | 2.595 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 3.120 | 11.200 | -2.595 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | -3.120 | 11.200 | -2.595 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 11.200 | 0.000 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 17.230 | 0.000 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 2.906 | 17.230 | -2.750 | 0 |
| 27 | 1 | 1 | 1 | 1 | 1 | 1 | 200.000 | 200.000 | 0.000 | 0 |

NUMBER OF NODE CARDS READ = 27

Fig. #AATQURA

| | |
|---------------------|--------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO. | 7093-210 |
| CALC/PROB NO. | 136-1 |
| BY: JN | DATE: 7/1/83 |
| CHKD: MDR | DATE: 7/7/83 |

BEAM GEOMETRIC PROPERTIES

| ELEMENT
TYPE | AREA
X | AREA
Y | AREA
Z | INERTIA
X | INERTIA
Y | INERTIA
Z |
|-----------------|-----------|-----------|-----------|--------------|--------------|--------------|
| 1 | 5.363E+00 | 2.681E+00 | 2.681E+00 | 2.404E+01 | 1.202E+01 | 1.202E+01 |
| 2 | 4.422E+00 | 2.211E+00 | 2.211E+00 | 3.511E+01 | 1.755E+01 | 1.755E+01 |
| 3 | 2.835E+00 | 1.417E+00 | 1.417E+00 | 3.150E+00 | 1.575E+00 | 1.575E+00 |
| 4 | 2.037E+00 | 1.358E+00 | 1.358E+00 | 3.820E-01 | 1.252E+00 | 9.500E-02 |
| 5 | 1.227E+00 | 9.200E-01 | 9.200E-01 | 2.400E-01 | 1.200E-01 | 1.200E-01 |
| 6 | 9.660E-01 | 4.830E-01 | 4.830E-01 | 3.950E-01 | 1.970E-01 | 1.970E-01 |
| 7 | 3.340E-01 | 2.500E-01 | 2.500E-01 | 6.800E-03 | 3.400E-03 | 3.400E-03 |
| 8 | 1.000E+02 | 1.000E+02 | 1.000E+02 | 1.000E+03 | 1.000E+03 | 1.000E+03 |

ELEMENT LOAD MULTIPLIERS

| | A | B | C | D |
|-------|----|----|----|----|
| X-DIR | 0. | 0. | 0. | 0. |
| Y-DIR | 0. | 0. | 0. | 0. |
| Z-DIR | 0. | 0. | 0. | 0. |

Fig. # AATQURA

| | |
|---------------------|--------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOE NO. | 0072-218 |
| CALCIPROP NO. | 1267 |
| BY: DN | DATE: 4/7/83 |
| CHKD: MUA | DATE: 4/7/83 |

| MATERIAL | YOUNG S
MODULUS | POISSON S
RATIO | MASS
DENSITY | DAMPING
RATIO |
|----------|--------------------|--------------------|-----------------|------------------|
| 1 | 2.930E+07 | 3.00000E-01 | 7.34000E-04 | 0. |
| 2 | 2.930E+07 | 3.00000E-01 | 1.00000E-09 | 0. |

Sg. # AATQURA

| | |
|---------------------|---------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO. | 293-270 |
| CALCIPROG NO. | 136-1 |
| BY | DN |
| DATE | 4/1/88 |
| CHECKED | MD |
| DATE | 4/2/88 |

..... NODAL POINT LOADS OR MASSES

| NODE NO | LOAD CASE | APPLIED LOADS OR MASSES | | | | | |
|---------|-----------|-------------------------|-----------|-----------|-----------|-----------|-----------|
| | | RX | RY | RZ | MX | MY | MZ |
| 26 | 0 | 5.980E-01 | 5.980E-01 | 5.980E-01 | 1.156E+01 | 5.819E+01 | 6.283E+01 |

Sgt. # KATAURA

| | |
|---------------------|----------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO | 0073-210 |
| CALCIPROB NO | 136-1 |
| BY | JN |
| DATE | 4/7/83 |
| CHKD | MAR |
| DATE | 4/7/83 |

SUMMARY OF MODES

| MODE | FREQ. (RAD/SEC) | FREQ. (CPS) | PERIOD |
|------|-----------------|-------------|---------|
| 1 | .123073E+03 | .203834E+02 | .049053 |
| 2 | .161683E+03 | .257327E+02 | .038861 |
| 3 | .192185E+03 | .305873E+02 | .032693 |

Seq. # AATQUA

| | |
|---------------------|-------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO. | 2293-210 |
| CALC/PROB NO. | 126-1 |
| BY: DWJ | DATE: 11/85 |
| CHKD: MGR | DATE: 12/85 |

DESIGN VERIFICATION

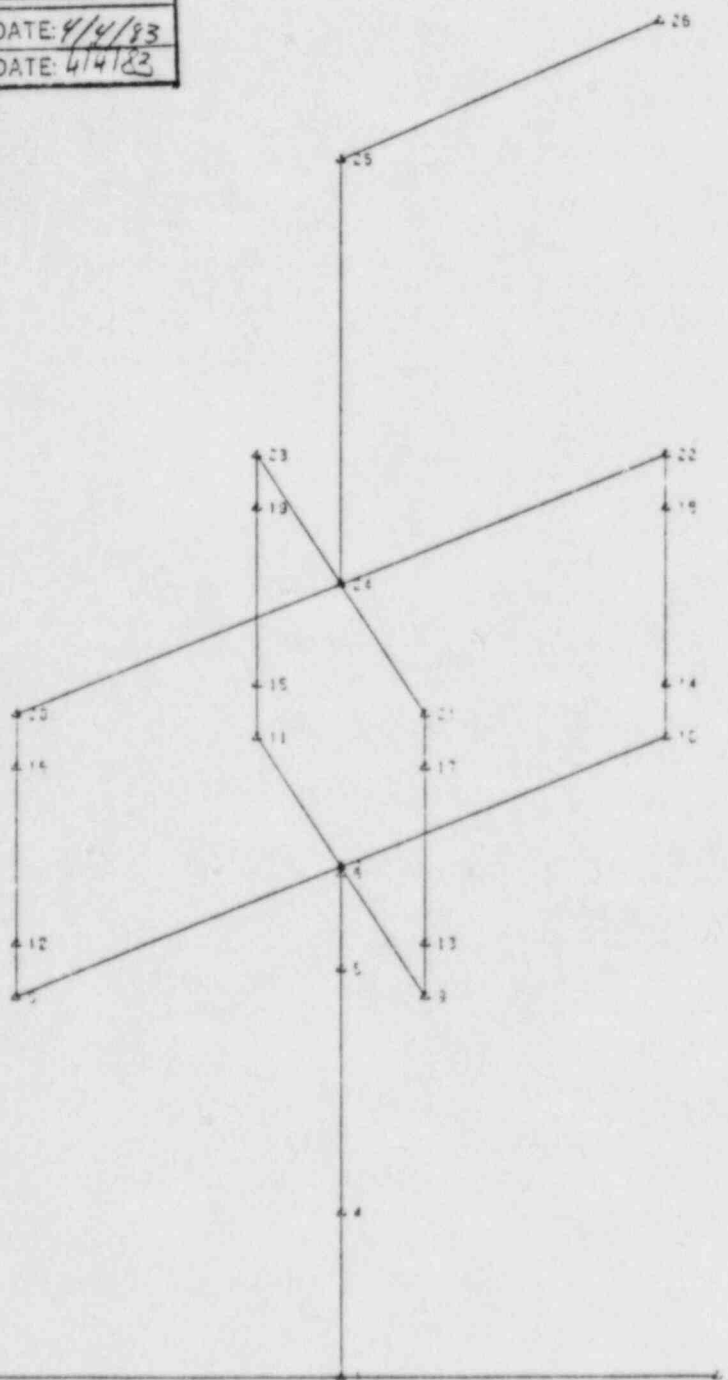
CLIENT DUKE: CATWBA

JOB NO. 0093-210-1362

CALC. PROB NO. 136-1

BY: DN DATE: 4/4/83

CHKD: WJ2 DATE: 4/4/83



FREQUENCY ITT CRINELL ITLM SB-473 CNM-1205.04-190

| SEAN | W | J | K | VAL-3504 | ELIM-0425 | C | I | EXI CODES | J | BAND |
|------|----|----|----|----------|-----------|---|---|-----------|---|------|
| 1 | 1 | 2 | 27 | 1 | 3 | 3 | 3 | 3 | 5 | 5 |
| 2 | 1 | 3 | 27 | 1 | 3 | 3 | 3 | 3 | 5 | 5 |
| 3 | 1 | 4 | 27 | 1 | 3 | 3 | 3 | 3 | 0 | 12 |
| 4 | 6 | 5 | 27 | 1 | 3 | 3 | 3 | 3 | 0 | 12 |
| 5 | 3 | 5 | 27 | 1 | 3 | 3 | 3 | 3 | 3 | 12 |
| 6 | 5 | 7 | 27 | 1 | 3 | 3 | 3 | 3 | 3 | 12 |
| 7 | 7 | 8 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 12 |
| 8 | 7 | 9 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 18 |
| 9 | 7 | 13 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 24 |
| 10 | 7 | 11 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 33 |
| 11 | 9 | 12 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 12 | 9 | 13 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 13 | 11 | 14 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 33 |
| 14 | 11 | 13 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 33 |
| 15 | 12 | 15 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 16 | 13 | 17 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 17 | 14 | 18 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 33 |
| 18 | 15 | 19 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 19 | 16 | 20 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 20 | 17 | 21 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 33 |
| 21 | 18 | 22 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 30 |
| 22 | 19 | 23 | 1 | 1 | 3 | 3 | 3 | 3 | 0 | 33 |
| 23 | 24 | 24 | 27 | 2 | 3 | 3 | 3 | 3 | 0 | 24 |
| 24 | 24 | 21 | 27 | 2 | 3 | 3 | 3 | 3 | 0 | 13 |
| 25 | 24 | 22 | 27 | 2 | 3 | 3 | 3 | 3 | 0 | 12 |
| 26 | 24 | 23 | 27 | 2 | 3 | 3 | 3 | 3 | 0 | 12 |
| 27 | 24 | 25 | 27 | 2 | 3 | 3 | 3 | 3 | 0 | 12 |
| 28 | 25 | 25 | 27 | 2 | 3 | 3 | 3 | 3 | 0 | 12 |

ELEMENT BANDWIDTH IS 33

Seq. # HATQUER

| DESIGN VERIFICATION | |
|---------------------|-------------|
| CLIENT | J VCE |
| JOB NO. | 0092-210 |
| CALC/PROB NO. | 135-T |
| BY: N | DATE: 11/15 |
| CHKD: M | DATE: 11/15 |

```

USER NUMBER = 10MRAYM
JOB CARD NAME = JOB

```

| | | | | | | | |
|------------|------------|------------|------------|--------------|--------------|--------------|------|
| AAAAAAAAAA | AAAAAAAAAA | TTTTTTTTTT | 2200000000 | FFFFFFFFFFFF | LL | VV | VV |
| AAAAAAAAAA | AAAAAAAAAA | TTTTTTTTTT | 2222000000 | FFFFFFFFFFFF | LL | VV | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AAAAAAAAAA | AAAAAAAAAA | TT | 22 | 00 | FFFFFFFF | LL | VV |
| AAAAAAAAAA | AAAAAAAAAA | TT | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | FF | LL | VV |
| AA | AA | AA | 22 | 00 | 00 | FF | VV |
| AA | AA | AA | 22 | 00 | 00 | FF | VV |
| AA | AA | AA | 22 | 00000000 | FF | LLLLLLLLLLLL | VVVV |
| AA | AA | AA | 2200000000 | FF | LLLLLLLLLLLL | VV | |

83/74/04. 13.45.13.4

[illegible]

FREQUENCY ANALYSIS

4th - 150 ITT GRINNELL VALVE, ITEM 58-473
ROTORK 14NA1 - mounted perpendicular
to pipe run axis.

$$f_1 = 20.01 \text{ Herz}$$

| | |
|---------------------|---------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE: CATAWBA |
| JOB NO. | 1093-210-1362 |
| CALC/PROB NO. | 136-1 |
| BY: DN | DATE: 4/2/93 |
| CHKD: MDR | DATE: 4/4/93 |

NUMBER OF MODAL POINTS = 27
 NUMBER OF ELEMENT TYPES = 1
 NUMBER OF -JAD CASES = 1
 NUMBER OF FREQUENCIES = 3
 ANALYSIS TYPE CODE = 2
 BLANK COMMON STORAGE SPECIFIED = 7475
 RESTART CODE = 2
 NUMBER OF FREQUENCIES/BLOCK = 3
 MODES (EIGEN VALUES) ANALYSIS CODE = 2

Sig # AATQZLV

| | |
|---------------------|----------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO | 0093-270 |
| CALC/PROP NO | 126-1 |
| BY | CH |
| DATE | 4/3/83 |
| CHECKED | MAR |

STORAGE REQUIRED IN ROUTINE.. GAP1

REQUIRED BLANK COMMON = 403
AVAILABLE BLANK COMMON = 7476

MODAL POINT DATA AS INPUT

MODE BOUNDARY CONDITION CODES
NUMBER C Y Z KK VV ZZ

| | | | | | | | | | | | |
|----|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 12 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 14 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 16 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 17 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 19 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 21 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 23 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 24 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 27 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

MODAL POINT COORDINATES

| X | Y | Z |
|---------|---------|--------|
| 0.000 | 0.000 | 0.000 |
| -5.750 | 0.000 | 0.000 |
| 5.750 | 0.000 | 0.000 |
| 0.000 | 2.311 | 0.000 |
| 0.000 | 5.750 | 0.000 |
| 0.000 | 7.133 | 0.000 |
| 0.000 | 7.203 | 0.000 |
| -3.120 | 7.203 | 2.595 |
| 3.120 | 7.203 | 2.595 |
| 3.120 | 7.203 | -2.595 |
| -3.120 | 7.203 | -2.595 |
| -3.120 | 7.953 | 2.595 |
| 3.120 | 7.953 | 2.595 |
| 3.120 | 7.953 | -2.595 |
| -3.120 | 7.953 | -2.595 |
| -3.120 | 10.453 | 2.595 |
| 3.120 | 10.453 | 2.595 |
| 3.120 | 10.453 | -2.595 |
| -3.120 | 10.453 | -2.595 |
| -3.120 | 11.203 | 2.595 |
| 3.120 | 11.203 | 2.595 |
| 3.120 | 11.203 | -2.595 |
| -3.120 | 11.203 | -2.595 |
| 0.000 | 17.234 | 0.000 |
| 0.000 | 17.234 | 0.000 |
| -2.750 | 17.234 | -2.936 |
| 200.000 | 200.000 | 0.000 |

NUMBER OF MODE CARDS READ = 27

Seq. # AATQ FLX

| | |
|---------------------|---------------------|
| DESIGN VERIFICATION | DATE |
| CLIENT DUK | 00/3-210 |
| JOB NO. 0073-210 | CALC PROB NO. 136-1 |
| BY DW | DATE 4/4/83 |
| CNO MURRAY | 44/83 |

| MATERIAL | YOUNG S
MODJLUS | POISSON S
RATIO | MASS
DENSITY | DAMPING
RATIO |
|----------|--------------------|--------------------|-----------------|------------------|
| 1 | 2.930E+07 | 3.00000E-01 | 7.34000E-40 | 0. |
| 2 | 2.930E+07 | 3.00000E-01 | 1.00000E-90 | 0. |

Seq. # AATQ FLV

| | |
|---------------------|--------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO. | 0043-210 |
| CALC/PROB NO. | 136-1 |
| BY: DN | DATE: 4/3/93 |
| CHKD: MAB | DATE: 4/8/93 |

EAM GEOMETRIC PROPERTIES

| ELEMENT
TYPE | AREA
X | AREA
Y | AREA
Z | INERTIA
X | INERTIA
Y | INERTIA
Z |
|-----------------|-----------|-----------|-----------|--------------|--------------|--------------|
| 1 | 5.353E+00 | 2.581E+00 | 2.581E+00 | 2.404E+01 | 1.202E+01 | 1.202E+01 |
| 2 | 4.422E+00 | 2.211E+00 | 2.211E+00 | 3.511E+01 | 1.755E+01 | 1.755E+01 |
| 3 | 2.335E+00 | 1.417E+00 | 1.417E+00 | 3.150E+00 | 1.575E+00 | 1.575E+00 |
| 4 | 2.037E+00 | 1.358E+00 | 1.358E+00 | 3.820E-01 | 1.252E+00 | 9.500E-02 |
| 5 | 1.227E+00 | 9.200E-01 | 9.200E-01 | 2.400E-01 | 1.200E-01 | 1.200E-01 |
| 6 | 9.550E-01 | 4.830E-01 | 4.830E-01 | 3.950E-01 | 1.970E-01 | 1.970E-01 |
| 7 | 3.341E-01 | 2.500E-01 | 2.500E-01 | 5.300E-03 | 3.400E-03 | 3.400E-03 |
| 8 | 1.000E+02 | 1.000E+02 | 1.000E+02 | 1.000E+03 | 1.000E+03 | 1.000E+03 |

ELEMENT LOAD MULTIPLIERS

| | A | B | C | D |
|-------|----|----|----|----|
| X-DIR | 0. | 0. | 0. | 0. |
| Y-DIR | 0. | 0. | 0. | 0. |
| Z-DIR | 0. | 0. | 0. | 0. |

Log. #AATQFLV

| | |
|---------------------|----------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO | 0013-210 |
| CALC/PROB NO | 136-1 |
| BY | DAW |
| DATE | 7/3/83 |
| TIME | 4:44 PM |

NCODE L0A0
 NO CASE
 25 1. 5.33E-11 5.33E-11 5.33E-11 5.233E+11 5.317E+01 1.155E+01
 RK RZ MX MY MZ

Fig. # AA7QFLV

| | |
|---------------------|-------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO | 0253-210 |
| CALC/PROB NO. | 136-1 |
| BY: | DATE 4/2/83 |
| CHECKED | DATE 4/2/83 |

SUMMARY OF MODES

| MODE | FREQ. (RAD/SEC) | FREQ. (CPS) | PERIOD |
|------|-----------------|-------------|----------|
| 1 | .125133E+13 | .201224E+02 | .049533E |
| 2 | .150199E+13 | .233525E+02 | .04174E |
| 3 | .204570E+13 | .325743E+02 | .03053E |

SQ. #1A TQFLV

| | |
|---------------------|--------------|
| DESIGN VERIFICATION | |
| CLIENT | DUKE |
| JOB NO. | 0973-210 |
| CALCIBO8 NO. | 136-1 |
| BY | DATE 1/13/83 |
| CHKD. | DATE 1/14/83 |

DESIGN VERIFICATION

CLIENT DUKE: CATAWBA

JOB NO. 0093-210-1362

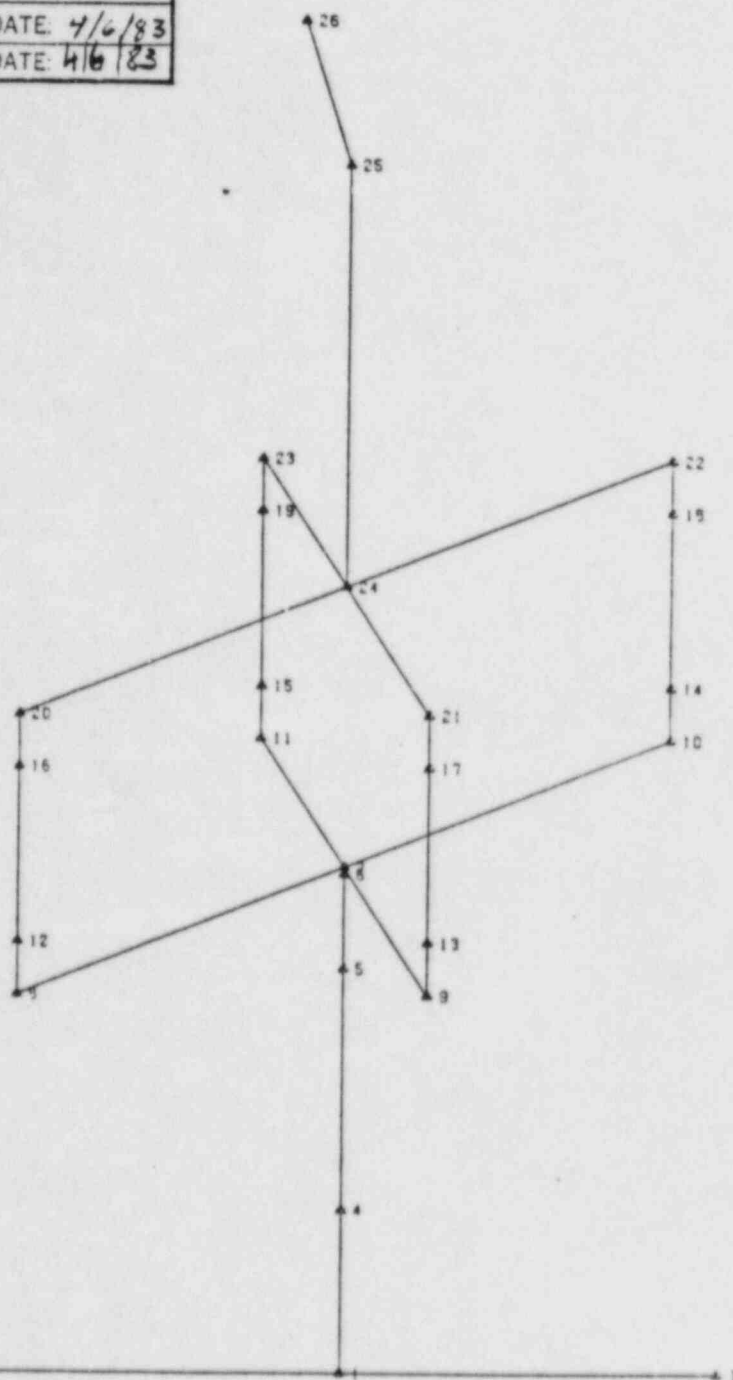
CALC/PROB NO. 136-1

BY: DN

DATE: 4/6/83

CHKD: MSR

DATE: 4/6/83



FREQUENCY ITT GRINNELL ITEM SB-473 ROTATED OPERATOR

| BEAM NO | NODES I | J | K | MATL SECT NO | A | B | C | ELEM LOADS | D | I | ENJ CODES J | BAND |
|---------|---------|----|----|--------------|---|---|---|------------|---|---|-------------|------|
| 1 | 1 | 2 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 2 | 1 | 3 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 3 | 1 | 4 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 4 | 4 | 5 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 5 | 5 | 6 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 6 | 6 | 7 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 7 | 7 | 8 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 8 | 7 | 9 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 9 | 7 | 10 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| 10 | 7 | 11 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 11 | 8 | 12 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 12 | 9 | 13 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 13 | 10 | 14 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 14 | 11 | 15 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 15 | 12 | 16 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 16 | 13 | 17 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 17 | 14 | 18 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 18 | 15 | 19 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 19 | 16 | 20 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 20 | 17 | 21 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 21 | 18 | 22 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 22 | 19 | 23 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 23 | 20 | 24 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 24 | 21 | 25 | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 25 | 22 | 26 | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 26 | 23 | 27 | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| 27 | 24 | 28 | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 28 | 25 | | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| | 26 | | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| | 27 | | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| | 28 | | 27 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |

ELEMENT BANDWIDTH IS 30

Fig. # 1112 FLW

| DESIGN VERIFICATION | |
|----------------------|--------------|
| CLIENT | DATE |
| JOB NO. 0043-210 | |
| CALC. PROB. NO. 13-1 | |
| BY: JN | DATE: 1/1/12 |
| CHKD: JN | DATE: 1/1/12 |

Attachment 4

Static Deflection Test
for
Valves VQ2A and VQ16A